(54) DATA TRANSMISSION SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To securely perform data transmission while evading a wire break position without providing any special control means for evading the wire break position for each terminal.
SOLUTION: A control unit, when receiving data to be sent from a transmission source terminal to a transmission destination terminal from a tail-end terminal, stores the received data in a data area corresponding to the tail-end terminal in a tail-end terminal table. Then the control unit judges that the line is broken if no reception confirmation response is received from the transmission-destination terminal and sends one piece of received data to the tail-end terminal having no data stored in the data area of the tail-end terminal table. Consequently, the control unit when receiving a reception confirmation response from the transmission-destination terminal through another

tail-end terminal judges that the data from the transmission-source terminal has been received securely by the transmission-destination terminal while avoiding the wire-break position.

CLAIMS

[Claim(s)]

[Claim 1] In the data transmission system which makes two or more set cable connection of the terminal which receives the data and transmits a confirmation-of-receipt response when self-addressed has data transmission, and performs data transmission mutually between each terminal One set only of a terminal and the connected terminal are used as an endmost part terminal among said each terminal, and the control unit connected by this endmost part terminal, the cable, or

wireless is formed. Said control unit The storage which an endmost part terminal is made to correspond and memorizes the data received from said endmost part terminal, The data transmission system which searches the endmost part terminal which was not able to receive data from the contents of said store, and is characterized by establishing the control means which transmits the same data as received data through the searched endmost part terminal when a confirmation-of-receipt response is able to be received [no] from endmost part terminals.

[Claim 2] In the data transmission system which makes two or more set cable connection of the terminal which receives the data and transmits a confirmation-of-receipt response when self-addressed has data transmission, and performs data transmission mutually between each terminal One set only of a terminal and the connected terminal are used as an endmost part terminal among said each terminal, and the control unit connected by this endmost part terminal, the cable, or wireless is formed. Said control unit The storage which prepared the 2nd table which memorizes the 1st table which an endmost part terminal is made to correspond and memorizes the data received from said endmost part terminal, the physical-connection condition between said each terminal, and an electrical installation condition, When a confirmation-of-receipt response is able to be received [no] from endmost part terminals, the endmost part terminal which was not able to receive data from the contents of said store is searched. The control means which performs control which receives the data from other endmost part terminals, and memorizes the right or wrong of an electrical installation condition on said 2nd table while transmitting the same data as received data through the searched endmost part terminal, The data transmission system characterized by establishing an open-circuit location specification means to pinpoint an open-circuit location from the contents of said 2nd table when data are memorized by said 1st table corresponding to all endmost part terminals.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]

[Field of the Invention] This invention relates to the data transmission system whose data transmission avoids an open-circuit location and is possible in communication networks, such as for example, the inside of an office, and domestic.

[0002]

[Description of the Prior Art] Cable connection of two or more terminals is made, and JP,8-51452,A is known as what avoids an open-circuit location and performs data transmission certainly in the data transmission system which transmits data between each terminal. This prepares the routing table which memorizes path information, exchanges path information for each terminal periodically, is in each terminal, updates the path information on the routing table in the end of a local, avoids an open-circuit location using the path information memorized by routing table at the time of transmission of data, and performs data transmission.

[0003] Moreover, cable connection of two or more terminals is made, and JP,5-327722,A is known in the data transmission system which transmits data between each terminal, for example as what can specify between which terminals it became communication link impossible when communication link impossible arose by failure, open circuit, etc. A call means of each operating station by which this asks for an affirmative response the data transmission unit between two or more operating stations which transmit and receive data from the call command to each of other operating station with the directions from the outside among two or more operating stations, The response processing control means of each operating station which performs control which it judges [control] whether the affirmative response was received in predetermined time from each called operating station, and makes the result memorize, and the failure decision means of each operating station which judges failure of each operating station from the existence of the memorized affirmative response data are established.

[0004]

[Problem(s) to be Solved by the Invention] However, the thing of JP,8-51452,A prepared routing table in each terminal, and since it had composition which exchanges path information for each terminal periodically, exists, and updates the path information on the routing table in the end of a local, it had the problem which a configuration and control of each terminal complicate. Moreover, since the thing of JP,5-327722,A must prepare a call means, a response processing control means, etc. in each terminal, and has the problem which a configuration and control of each terminal complicate and transmitted the affirmative response for fault detection, it will occupy a transmission line in the meantime, cannot perform original data transmission, and had the problem to which the transmission efficiency of data worsens.

[0005] Then, invention claim 1 and given in two does not need to establish the special control means for avoiding an open-circuit location to each terminal, therefore can simplify a system-wide configuration, and offers the data transmission system which avoids an open-circuit location and can moreover do data transmission certainly. Moreover, invention according to claim 2 can pinpoint an open-circuit location, without establishing the special control means for pinpointing an open-circuit location to each terminal further, can simplify a system-wide configuration also by this, and offers the data transmission system which can prevent that the transmission efficiency of data falls for open-circuit detection as much as possible.

[0006]

[Means for Solving the Problem] In the data transmission system which makes two or more set cable connection of the terminal which receives the data and transmits a confirmation-of-receipt response, and performs data transmission mutually between each terminal when invention according to claim. 1 has data transmission in self-addressed One set only of a terminal and the connected terminal are used as an endmost part terminal among each terminal, and the control unit connected by this endmost part terminal, the cable, or wireless is formed. This control unit The storage which an endmost part terminal is made to correspond and memorizes the data received from the endmost part terminal, When a confirmation-of-receipt response is [no] unreceivable from endmost part terminals, the endmost part terminal which was not able to receive data from the contents of the store is searched, and the control means which transmits the same data as received data through the searched endmost part terminal is established.

[0007] In the data transmission system which makes two or more set cable connection of the terminal which receives the data and transmits a confirmation-of-receipt response, and performs data transmission mutually between each terminal when invention according to claim 2 has data transmission in self-addressed One set only of a terminal and the connected terminal are used as an endmost part terminal among each terminal, and the control unit connected by this endmost part terminal, the cable, or wireless is formed. This control unit The storage which prepared the 2nd table which memorizes the 1st table which an endmost part terminal is made to correspond and memorizes the data received from the endmost part terminal, the physical-connection condition between each terminal, and an electrical installation condition, When a confirmation-of-receipt response is able to be received [no] from endmost part terminals, the endmost part terminal which was not able to receive data from the contents of the store is searched. The control means which performs control which

receives the data from other endmost part terminals, and memorizes the right or wrong of an electrical installation condition on the 2nd table while transmitting the same data as received data through the searched endmost part terminal, An open-circuit location specification means to pinpoint an open-circuit location from the contents of the 2nd table when data are memorized by the 1st table corresponding to all endmost part terminals is established.

[0008]

[Embodiment of the Invention] The gestalt of operation of this invention is explained with reference to a drawing.

(Gestalt of the 1st operation) Drawing 1 is the block diagram showing a system-wide configuration, and this system consists of 11 terminals of a terminal A1, terminal B-2, a terminal C3, a terminal D4, a terminal E5, a terminal F6, a terminal G7, a terminal H8, a terminal I9, a terminal J10, and a terminal K11, and one control unit 12, and constitutes the node branch-type network mutually.

[0009] Namely, said terminal A1 is connected with terminal B-2 and a terminal C3 through the cable-transmission ways 13 and 14, respectively. Said terminal B-2 connects with a terminal D4 and a terminal E5 through the cable-transmission ways 15 and 16, respectively. Said terminal C3 is connected with a terminal G7 and a terminal H8 through the cable-transmission ways 17 and 18, respectively. As for said terminal D4, it connected with the terminal J10 and the terminal K11 through the cable-transmission ways 19 and 20, respectively, and it connected with the terminal F6 through the cable-transmission way 21, and said terminal E has connected said terminal H8 with the terminal I9 through the cable-transmission way 22.

[0010] In addition, computer-related peripherals, such as various AV equipments, such as a personal computer which constitutes LAN in the company as a terminal, for example, a printer or a videocassette recorder which constitutes a domestic network through node branch-type with a high degree of freedom or the IEEE1394 high-speed serial bus interface in which daisy chain connection is possible, DVD and TV, and a video camera, a personal computer, a scanner, CD-ROM, and a hard disk, etc. correspond.

[0011] Among said each terminals 1-11, a terminal F6, a terminal G7, a terminal I9, a terminal J10, and a terminal K11 are endmost part terminals connected to one set only of a terminal, respectively, and have connected said control unit 12 to these endmost part terminals F6, G7, I9, J10, and K11 through the transmission line 23 for emergencies of a cable, respectively. Drawing 2 shows a format of the transmit data which flows a transmission line, and this transmit data attaches a code and a

transmitting agency terminal code as a header in the end of a transmitting tip.

[0012] the port 311 connected to said each endmost part terminals F6, G7, I9, J10, and K11 through the transmission line 23 for emergencies as said control unit 12 is shown in drawing 3 , 312, 313, 314, ··31n It consists of the transmitting section and a receive section, and is 311-31n of said each port. Means of communications 32 which minds and performs transmission and reception of said each endmost part terminals F6, G7, I9, J10, and K11 and data, It constitutes from a control means 35 which controls an open-circuit location specification means 33 to perform processing which pinpoints an open-circuit location, storage 34, and said means of communications 32, the open-circuit location specification means 33 and storage 34. In addition, the function performed by the program of a microcomputer constitutes said means of communications 32, the open-circuit location specification means 33, and a control means 35.

[0013] As shown in said storage 34 at drawing 4 , the codes F, G, I, J, and K of each of said endmost part terminals F6, G7, I9, J10, and K11 are set up. Endmost part terminal table 34a which memorizes the data received from the endmost part terminals F6, G7, I9, J10, and K11 in the data storage area corresponding to the corresponding endmost part terminal code, Code A-K of each of said terminals 1-11 is set up. While setting up the code of the terminal connected corresponding to each of this code A-K and showing the physical-connection condition on a network with each terminal, it has connection terminal table 34b which prepared the area which memorizes an actual electrical installation condition with the terminal in that physical-connection condition. And "1" is set to the area which memorizes said electrical installation condition when a normal-connection condition is checked.

[0014] Said control unit 12 performs program control based on the flow chart shown in drawing 5 . This control checks a network connection configuration at step S1 first. And whenever a new terminal is connected, this network connection configuration is checked. This check is performed based on said connection terminal table 34b, and if a new terminal is connected, the contents of said connection terminal table 34b and endmost part terminal table 34a will be rewritten.

[0015] And if it stands by from an endmost part terminal to data reception and there is reception of data from an endmost part terminal at step S2, data will be memorized at step S3 to endmost part terminal table 34a and connection terminal table 34b. That is, received data are memorized to the data area corresponding to the code of the endmost part terminal which transmitted received data to endmost part terminal table 34a, and "1" is set to the electrical installation condition storage area between the terminals with which the normal connection was checked by connection terminal table 34b.

[0016] Then, if there is reception of "a confirmation-of-receipt response" from the end of a transmitting tip which performed data transmission via all endmost part terminals from all endmost part terminals, the received data memorized to said endmost part terminal table 34a in step S4 will be eliminated. Moreover, if there is no reception of "a confirmation-of-receipt response" from the end of a transmitting tip which performed data transmission via the endmost part terminal from anywhere, it will judge that the open circuit has occurred in somewhere, and the data of addressing will be transmitted in the end of a transmitting tip it received to one of the endmost part terminals which has not memorized received data to the data area of said endmost part terminal table 34a at step S5. And the data transmitted to the data area corresponding to the endmost part terminal which transmitted the data in endmost part terminal table 34a at step S6 are memorized.

[0017] And if there is reception of data via an endmost part terminal, "1" will be set to the electrical installation condition storage area between the terminals with which the normal connection in said connection terminal table 34b was checked while memorizing the data received at step S7 to the data area corresponding to the endmost part terminal in said endmost part terminal table 34a.

[0018] Then, via an endmost part terminal, if reception of "a confirmation-of-receipt response" from the end of a transmitting tip is also one If it judged that data were transmitted in the end of a transmitting tip, data are buried at the time at the data area of said endmost part terminal table 34a and there is a **** endmost part terminal The data transmitted to the data area corresponding to the endmost part terminal which transmitted the data for open-circuit location specification to one of the endmost part terminals with which data are not buried with step S8, and transmitted the data in endmost part terminal table 34a in step S9 are memorized.

[0019] And if there is reception of data via an endmost part terminal, "1" will be set to the electrical installation condition storage area between the terminals with which the normal connection in said connection terminal table 34b was checked while memorizing the data received at step S10 to the data area corresponding to the endmost part terminal in said endmost part terminal table 34a.

[0020] Henceforth, if this is repeated and data are buried with all data areas until data are buried with the data area corresponding to each endmost part terminal of said endmost part terminal table 34a, at step S11, based on the contents of the electrical installation condition storage area of said connection terminal table 34b, an open-circuit location will be pinpointed with the open-circuit location specification means 33, and a series of control will be ended.

[0021] In such a configuration for example, when all the transmission lines 13-22 are normal If the data of the format which a terminal H8 makes a terminal D4 a transmission place, and is shown in drawing 2 are transmitted, data will be further transmitted also to the endmost part terminal J10 and the endmost part terminal K11 via a terminal D4 while being transmitted to a terminal D4 via a terminal C3, a terminal A1, and terminal B-2 as a junction terminal. Moreover, it is transmitted also to the endmost part terminal F6 via a terminal E5 from terminal B-2. Moreover, it is transmitted also to the endmost part terminal G7 via a terminal C3. Furthermore, it is transmitted also to the endmost part terminal I9.

[0022] A control unit 12 receives by this the data which the terminal D4 transmitted through the transmission line 23 for emergencies from all the endmost part terminals F6, G7, I9, J10, and K11. It is (a) of drawing 7 to the data area corresponding to all the endmost part terminals of endmost part terminal table 34a. The received data which consist of a "Code D" transmitting former terminal code "H" and data in the end of a transmitting tip so that it may be shown are memorized. Moreover, (b) of drawing 7 "1" is set to all the electrical installation condition storage areas of each terminal of connection terminal table 34b, and the terminal which is in a connection condition physically so that it may be shown. In addition, all electrical installation condition storage areas are "0" at first.

[0023] Since received data are data addressed to the end of a local, end D4 of a transmitting tip incorporates this, and it returns "a confirmation-of-receipt response" to all other terminals. If the transmission line is normal, this "confirmation-of-receipt response" will be transmitted to a control unit 12 through all the endmost part terminals F6, G7, I9, J10, and K11 and transmission lines 23 for emergencies. A control unit 12 is (a) of drawing 8 , when it checks that there has been "a confirmation-of-receipt response" from all the endmost part terminals F6, G7, I9, J10, and K11. The data memorized to the data area corresponding to each endmost part terminal of endmost part terminal table 34a so that it might be shown are eliminated. On the other hand, all the electrical installation condition storage areas in connection terminal table 34b hold the set condition of "1."

[0024] Moreover, as shown in drawing 9 , supposing the open circuit has occurred for example, in the transmission line 15 between terminal B-2 and a terminal D4, and the transmission line 18 between a terminal C3 and a terminal H8, a terminal H8 will make a terminal D4 a transmission place for an open circuit at not knowing, and will transmit data. Since the transmission line 18 is disconnected, data are transmitted only to the endmost part terminal I9. A control device 12 receives data only from the endmost

part terminal I9, and is (a) of <u>drawing 10</u> to endmost part terminal table 34a. Data are memorized only to the data area corresponding to the endmost part terminal I9 so that it may be shown. Moreover, it is (b) of <u>drawing 10</u> to connection terminal table 34b. "1" is set only to the electrical installation condition storage area between the terminals H8 and the endmost part terminals I9 in a physical-connection condition so that it may be shown, and it recognizes that the transmission line 22 is not disconnected.

[0025] Then, since "a confirmation-of-receipt response" is not sent from the terminal D4 of a transmission place even if fixed time amount passes, it recognizes that the open circuit has generated the control unit 12 in somewhere. And a control device 12 transmits the data addressed to D4 in the end of a transmitting tip it received to the largest endmost part terminal K11 of a code among the endmost part terminals F6, G7, J10, and K11 with which the data of endmost part terminal table 34a are not memorized as an arrow head shows to <u>drawing 11</u> . And this transmitted data is memorized to the data area corresponding to the endmost part terminal K11 of endmost part terminal table 34a.

[0026] The data transmitted to the endmost part terminal K11 are transmitted to D4 in the end of a transmitting tip. A terminal D4 checks that data are data of addressing in the end of a local, and incorporates this data. Thus, an open-circuit location can be avoided and the data from a terminal H8 can transmit to a terminal D4 certainly. And it is not necessary to establish a control means special to each terminals 1-11, and that you may connect with one control unit 12 in common can only simplify a system-wide configuration for the endmost part terminals F6, G7, I9, J10, and K11 through the transmission line 23 for emergencies.

[0027] Moreover, data are transmitted also to the endmost part terminal J10 via a terminal D4. At this time, since the transmission line 15 is disconnected, data are not transmitted to terminal B-2. In this way, data will be transmitted to a control unit 12 via the endmost part terminal J10. Thereby, a control device 12 receives this data and memorizes it to the data area corresponding to the endmost part terminal J10 of endmost part terminal table 34b. In this way, the contents of endmost part terminal table 34a are (a) of <u>drawing 12</u> . It comes to be shown. Moreover, it is (b) of <u>drawing 12</u> to connection terminal table 34b. "1" is set to the electrical installation condition storage area between the endmost part terminals K11 and terminals D4 in a physical-connection condition, and between a terminal D4 and the endmost part terminal J10 so that it may be shown, and it recognizes that transmission lines 20 and 19 are not disconnected.

[0028] Then, D4 returns "a confirmation-of-receipt response" to all other terminals in

the end of a transmitting tip. This "confirmation-of-receipt response" is told to a control unit 12 via the endmost part terminals J10 and K11. in this way, the control device 12 -- data -- a transmitting tip -- it is checked that it has been certainly transmitted to D4 at last.

[0029] However, at this time, the open-circuit location is not pinpointed yet. Then, a control device 12 is transmitted to the endmost part terminal G7 with a large code among the remaining endmost part terminals F6 and G7 through [to <u>drawing 13</u> / as an arrow head shows] the transmission line 23 for emergencies for the data for open-circuit location specification which made the transmission place code the multicast and made the transmitting agency code the ID code. And this transmitted data is memorized to the data area corresponding to the endmost part terminal G7 of endmost part terminal table 34a.

[0030] It is transmitted to the endmost part terminal F6 from the endmost part terminal G7 via a terminal C3, a terminal A1, terminal B-2, and a terminal E5, and this transmit data is transmitted to a control unit 13 from the endmost part terminal F6. In this way, a control device 12 memorizes this received data for open-circuit location specification to the data area corresponding to the endmost part terminal F6 of endmost part terminal table 34a. In this way, (a) of <u>drawing 14</u> Data will be memorized by all the data areas corresponding to each endmost part terminal of endmost part terminal table 34a so that it may be shown. Moreover, since transmission lines 15 and 18 have disconnected the transmit data at this time, it is not transmitted to a terminal D4 and a terminal H8.

[0031] At this time Having not disconnected the control unit 12 about the transmission line 17 between a terminal G7 and a terminal C3, the transmission line 14 between a terminal C3 and a terminal A1, the transmission line 13 between a terminal A1 and terminal B-2, the transmission line 16 between terminal B-2 and a terminal E5, and the transmission line 21 between a terminal E5 and a terminal F6 It can check and is (b) of <u>drawing 14</u> . "1" is set to the electrical installation condition storage area to which connection terminal table 34b corresponds so that it may be shown.

[0032] In this way, since data were memorized by all the data areas corresponding to each endmost part terminal of endmost part terminal table 34a, it can specify that the transmission line 15 between terminal B-2s and the terminals D4 which exist from connection terminal table 34b in this time as an electrical installation condition storage area is "0", and the transmission line 18 between a terminal C3 and a terminal H8 are disconnected.

[0033] Thus, since pinpointing of an open-circuit location can be performed with the

control unit 12 connected with the endmost part terminals F6, G7, I9, J10, and K11 through the transmission line 23 for emergencies, it is not necessary to establish the special control means for pinpointing an open-circuit location to each terminals 1-11. Therefore, a system-wide configuration can be simplified also in this point. And that what is necessary is not to perform data transmission of its dedication periodically in order to usually inspect an open circuit, and just to usually perform data transmission of a passage, since data transmission for beginning when abnormalities occur at the time of data transmission, and pinpointing an open-circuit location is performed, it can prevent that the transmission efficiency of data falls for open-circuit detection as much as possible.

[0034] (Gestalt of the 2nd operation) In addition, the same sign is given to the same part as the gestalt of the 1st operation mentioned above, and a different part is explained. As shown in drawing 15 , this is what replaced with the transmission line for emergencies of a cable, and used the transmission line for emergencies of wireless, and provides the wireless sections 41, 42, 43, 44, and 45 and antennas 46, 47, 48, 49, and 50 in each endmost part terminals F6, G7, I9, J10, and K11, respectively.

[0035] Moreover, it is 311-31n of ports to a control unit 12. It replaced with and the wireless section 51 and an antenna 52 are formed. In such a configuration, since the data transmission between each endmost part terminals F6, G7, I9, J10, and K11 and a control device 12 can carry out on radio, the degree of freedom of the arrangement location of a control device 12 becomes large, and there is also no trouble of wiring. In addition, of course, the same operation effectiveness as the gestalt of the 1st operation mentioned above also in the gestalt of this operation is acquired.

[0036]

[Effect of the Invention] According to invention claim 1 and given in two, it is not necessary to establish the special control means for avoiding an open-circuit location to each terminal, therefore a system-wide configuration can be simplified, moreover, an open-circuit location is avoided and data transmission can be done certainly. Moreover, according to invention according to claim 2, an open-circuit location can be pinpointed without establishing the special control means for pinpointing an open-circuit location to each terminal further, a system-wide configuration can be simplified also by this, and it can prevent that the transmission efficiency of data falls for open-circuit detection as much as possible.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram in which showing the gestalt of operation of the 1st of this invention, and showing a system-wide configuration.

[Drawing 2] Drawing showing the data format used with the gestalt of this operation.

[Drawing 3] The block diagram showing the configuration of the control device in the gestalt of this operation.

[Drawing 4] Drawing showing the configuration of the endmost part terminal table of the store in the gestalt of this operation, and a connection terminal table.

[Drawing 5] The flow chart showing the program control by the control unit in the gestalt of this operation.

[Drawing 6] Drawing for explaining the actuation of forward always in the system of the gestalt of this operation.

[Drawing 7] Drawing showing the condition of the endmost part terminal table at the time of the normal actuation in the system of the gestalt of this operation, and a connection terminal table.

[Drawing 8] Drawing showing the condition of the endmost part terminal table at the time of the normal actuation in the system of the gestalt of this operation, and a connection terminal table.

[Drawing 9] Drawing for explaining the actuation at the time of open-circuit generating in the system of the gestalt of this operation.

[Drawing 10] Drawing showing the condition of the endmost part terminal table at the time of open-circuit generating in the system of the gestalt of this operation, and a connection terminal table.

[Drawing 11] Drawing for explaining the actuation at the time of open-circuit generating in the system of the gestalt of this operation.

[Drawing 12] Drawing showing the condition of the endmost part terminal table at the time of open-circuit generating in the system of the gestalt of this operation, and a connection terminal table.

[Drawing 13] Drawing for explaining the actuation at the time of open-circuit generating in the system of the gestalt of this operation.

[Drawing 14] Drawing showing the condition of the endmost part terminal table at the time of open-circuit generating in the system of the gestalt of this operation, and a connection terminal table.

[Drawing 15] The block diagram in which showing the gestalt of operation of the 2nd of this invention, and showing a system-wide configuration.

[Drawing 16] The block diagram showing the configuration of the control device in the gestalt of this operation.

[Description of Notations]

1-11 -- Terminal

12 -- Control unit

13-22 -- Cable-transmission way

23 -- Transmission line for emergencies

33 -- Open-circuit location specification means

34a -- Endmost part terminal table

34b -- Connection terminal table